

# SOA at Union Pacific Railroad

## *Technology to Support Business Growth*

Lynden Tennison, Senior Vice President and CIO, April 21, 2010

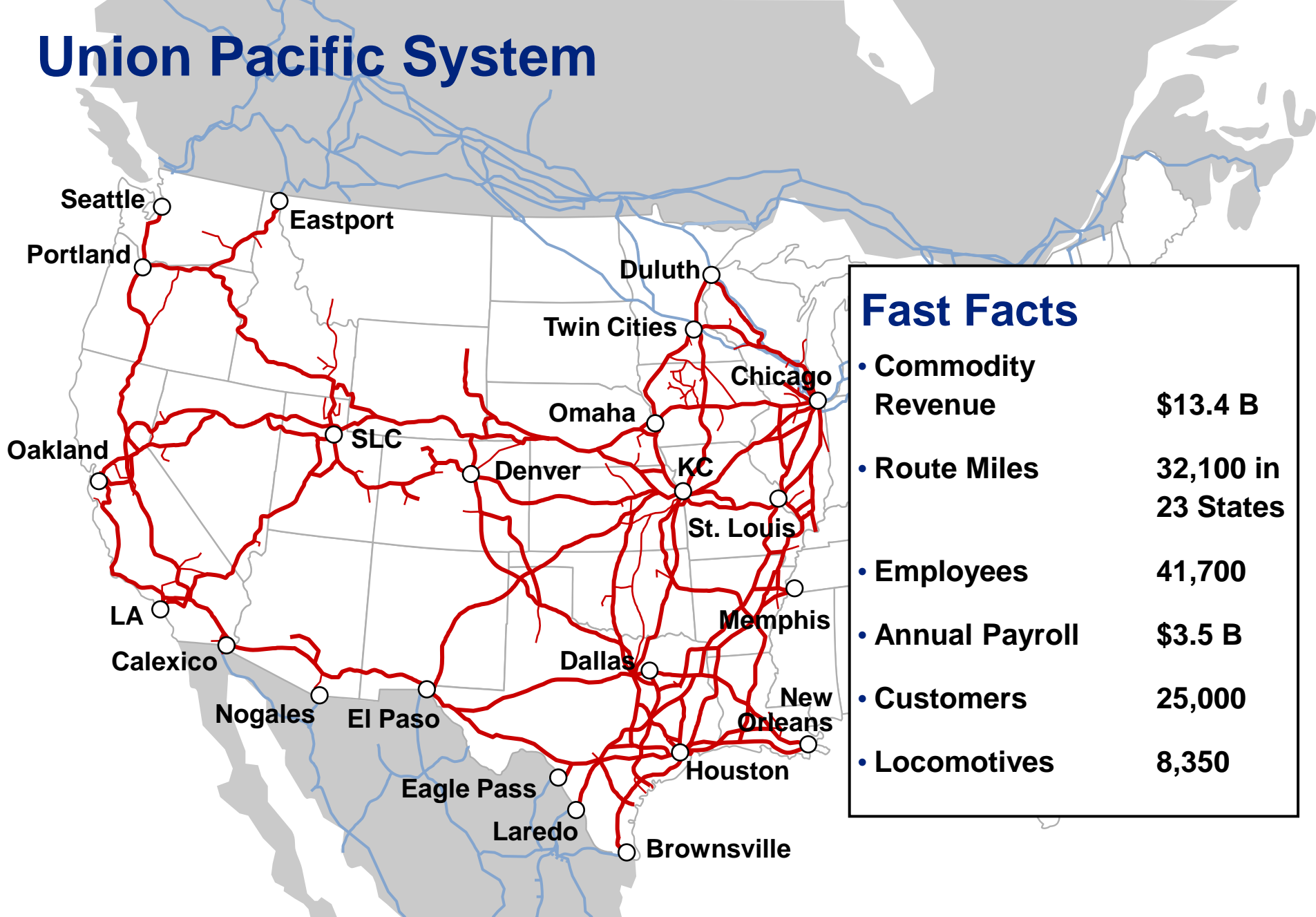


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# Agenda

- **Company Overview**
- **IT Goals**
- **SOA Timeline at UP**
- **Reality Check**
- **Where are We Now?**
- **Future of SOA at UP**

# Union Pacific System



## Fast Facts

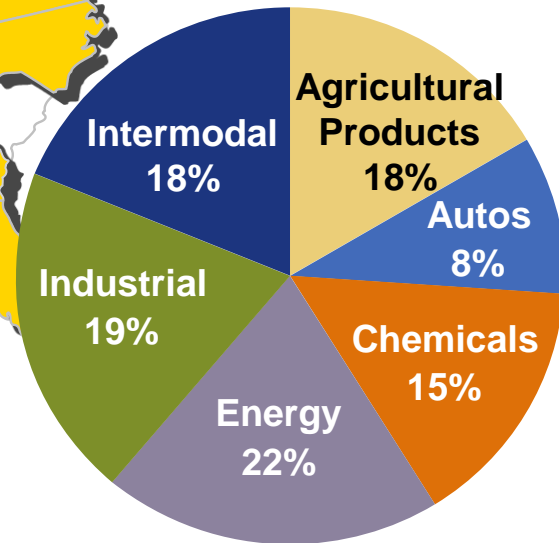
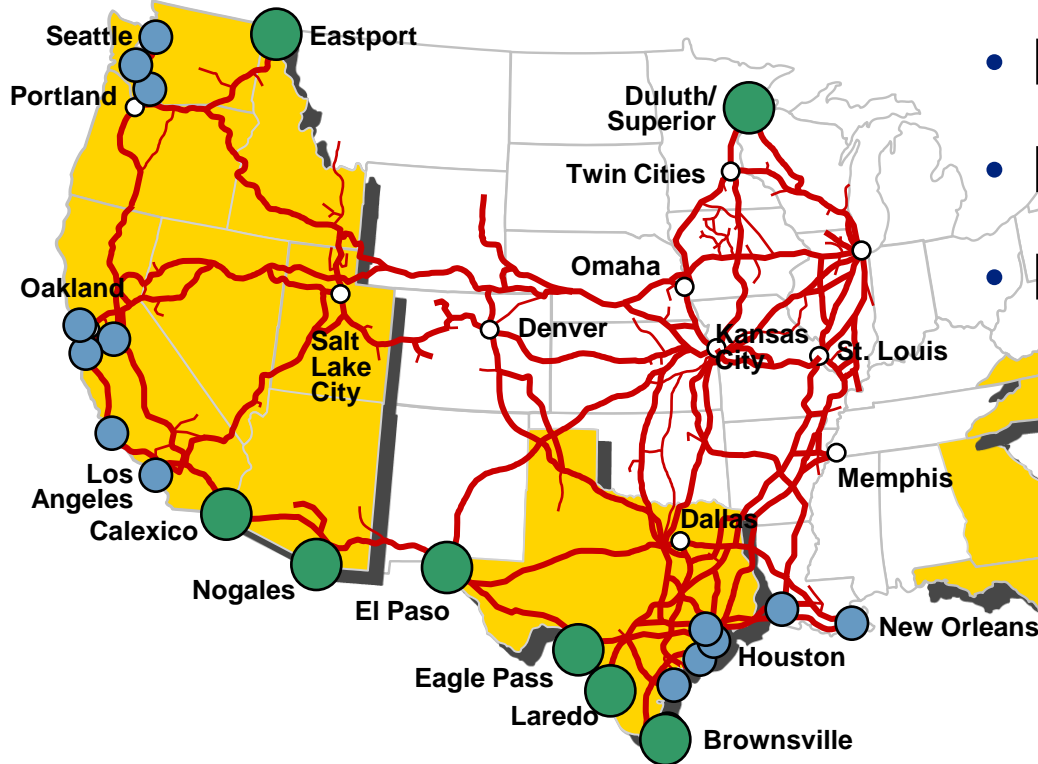
• Commodity Revenue	\$13.4 B
• Route Miles	32,100 in 23 States
• Employees	41,700
• Annual Payroll	\$3.5 B
• Customers	25,000
• Locomotives	8,350



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# The Strength of a Unique Franchise

- Diverse Business Mix
- Fastest Growing States
- Port Access
- Border Crossings

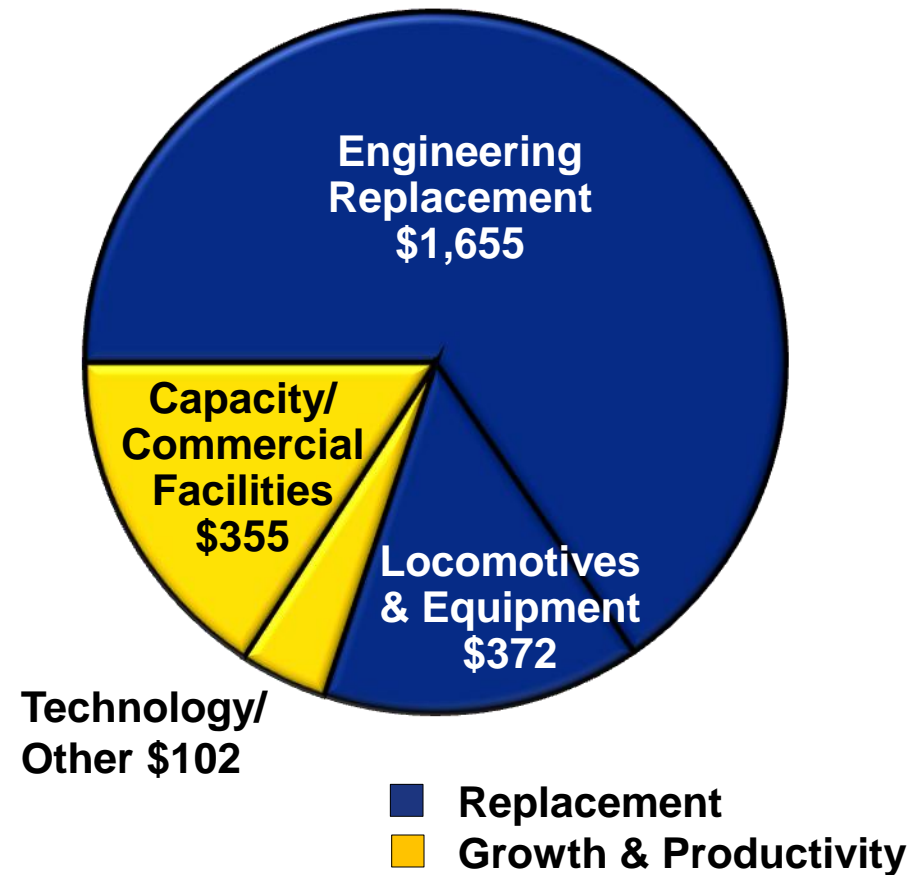


2008 Business Mix

# 2009 Capital Investments

- Replacement / renewal programs
  - Safety
  - Velocity
  - Throughput
- Long-term growth projects
  - Sunset / intermodal
  - Coal capacity / Red X
- Enhance throughput productivity

## \$2.484 Billion Capital Plan *In Millions*





# Benefits of Freight Railroads



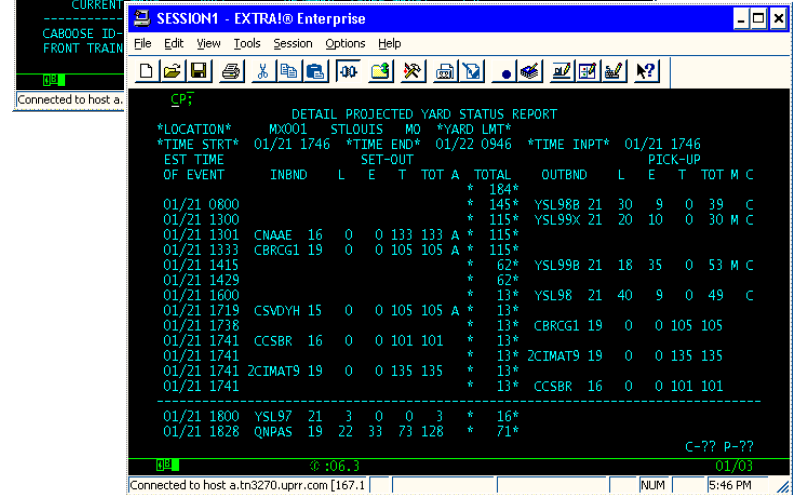
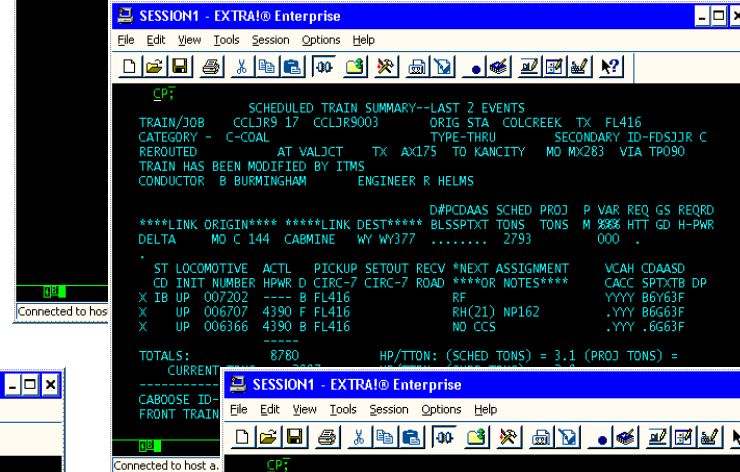
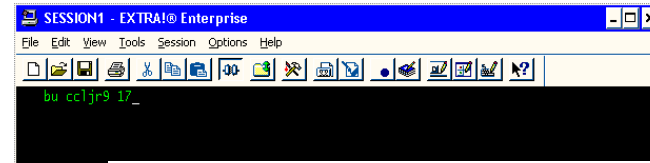
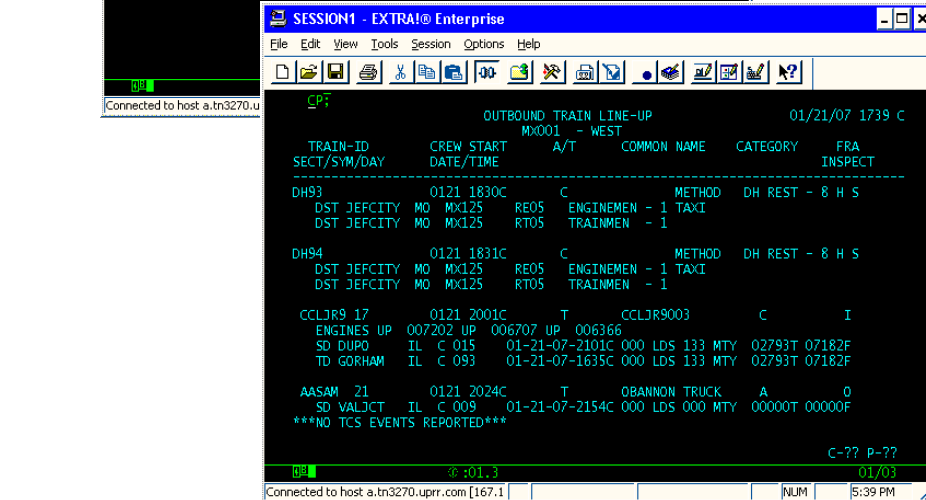
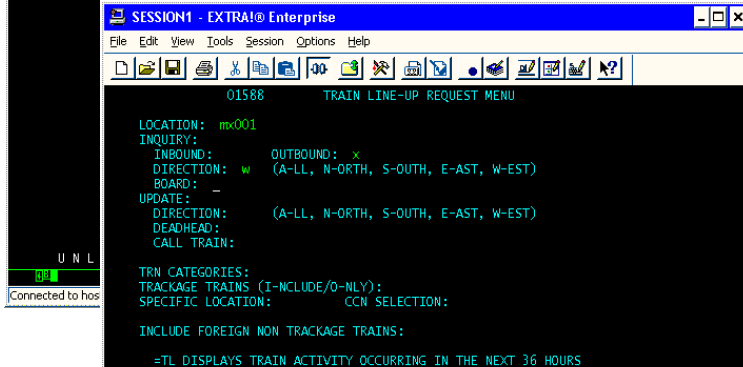
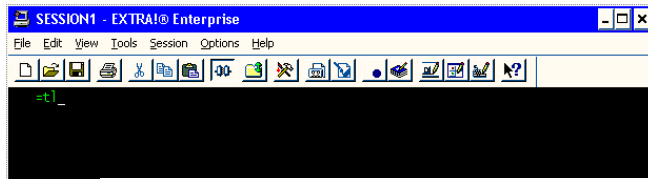
- Safest mode of transportation
- Four times more fuel efficient than trucks
- Reduces dependency on foreign oil
- Cuts emissions by two thirds
- One train takes 300 trucks off congested highways
- Avoids massive taxpayer investment in roads
- Saves customers billions on logistics costs

# The Challenge





# Where we were



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# Legacy TCS - Characteristics

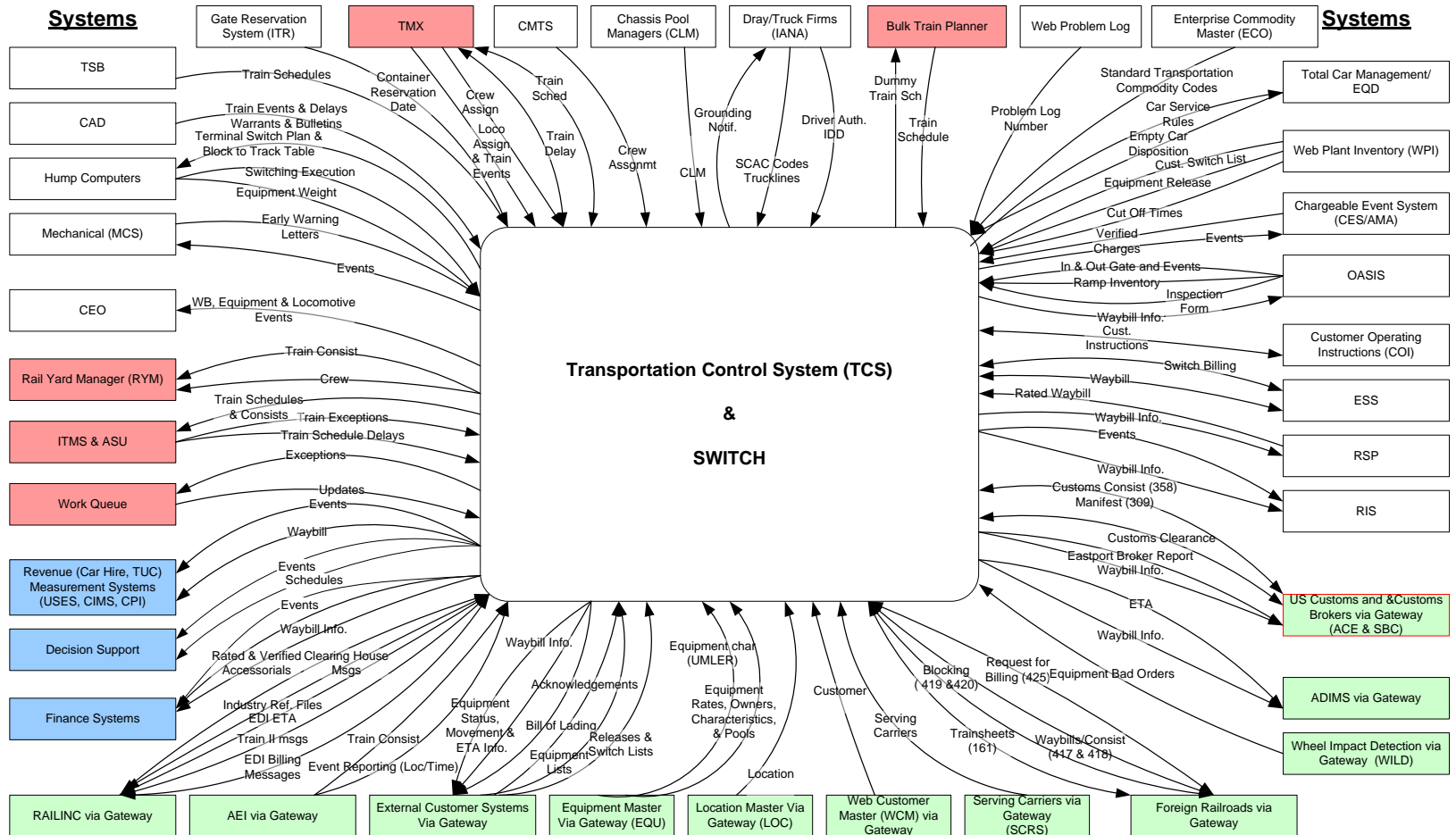
- 8000 online TPSS/RAIL (mainframe assembler) or COBOL programs
- 11 million lines of source code
- 1900 online files
- 6 million transactions per day

## SAMPLE RAIL CODE

```
TITLE 'INPUT INTERCHANGE DATA-MINLINE'
R510001INITIATE DATA=(D2080,R2),BASE=(R11,R10)
              GETCORE MEMODSZ,R3
              USING MEMODSX,R3
              FILL XZERO,D8555,D8539,D8535
              FILL ZERO,YDNOICWA,CONTRLWA,CURSORWA
              SPACE 2
              SETSW S FREFFGWA,OFF
              SETSW ERRFLGWA,OFF
              STOREG R3,ADMEMOWA
              INIDSPY
              INITMSG D3300
              BAC5 EQU *
              MOV KMSG01WA,KMSG01XX
              SENDLINE D3300
```

# Surround and Extend

TCS APP011 - System Context Diagram (As Is)



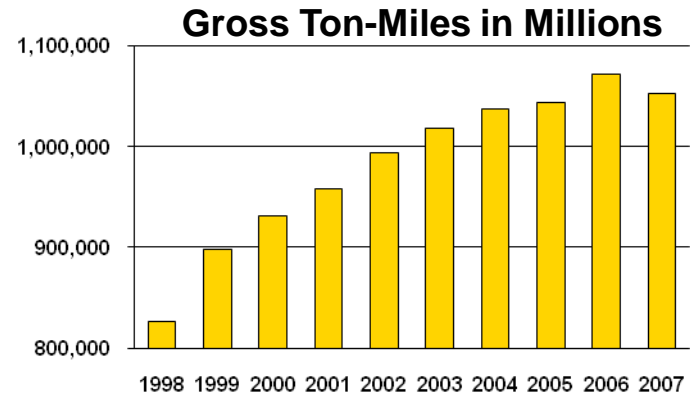
# Technology Drivers

- **Supportability of TCS**
  - Attrition
  - TPSS/RAIL
  - Slow development
- **System integration**
  - Data model
  - System “spider web”
  - Icons everywhere!
- **Scalability**
  - File limits



# Business Drivers

- **Volume Growth**
  - Short range planning
  - Event response
- **New Business Models**
  - Specialized services
  - New revenue sources
- **Changing workforce demographics**
  - Automate decision making / process control
  - Minimize training curve
- **Employee efficiency improvement**
  - Eliminate manual reporting
  - Alerts / Workflow vs. transactions





# Challenge: How to sell it?

- Test ideas
- No BIG BANG!
- Incremental benefits
- Find friends
- Bet your career

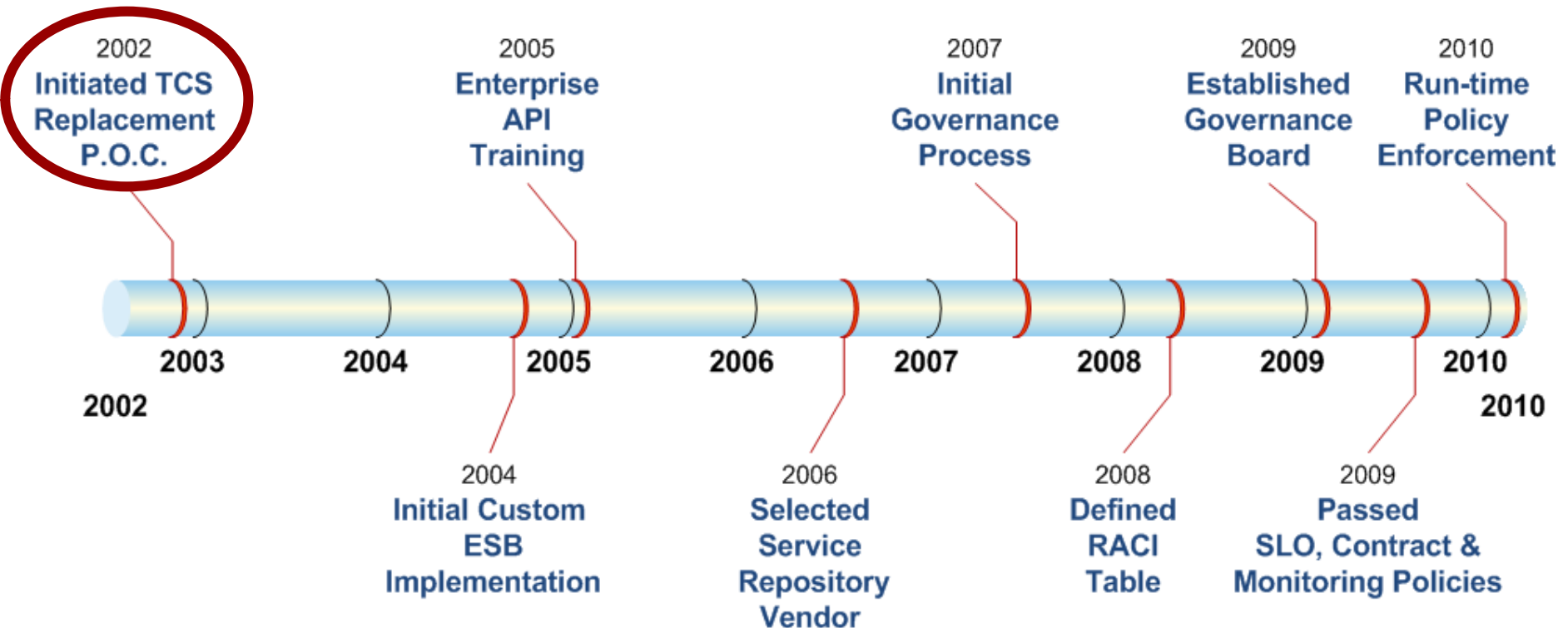


# Migration Strategy

- **Migrate master data**
- **Isolate and migrate “non-core”**
- **Full-featured web front-end**
- **Seamless User Interface**
- **Complex event processing**
- **GIS resource toolkit**
- **Reverse engineer/ reengineer business processes**
- **Archive legacy code as soon as possible**
- **Migrate the IT staff**



# History of SOA at UP



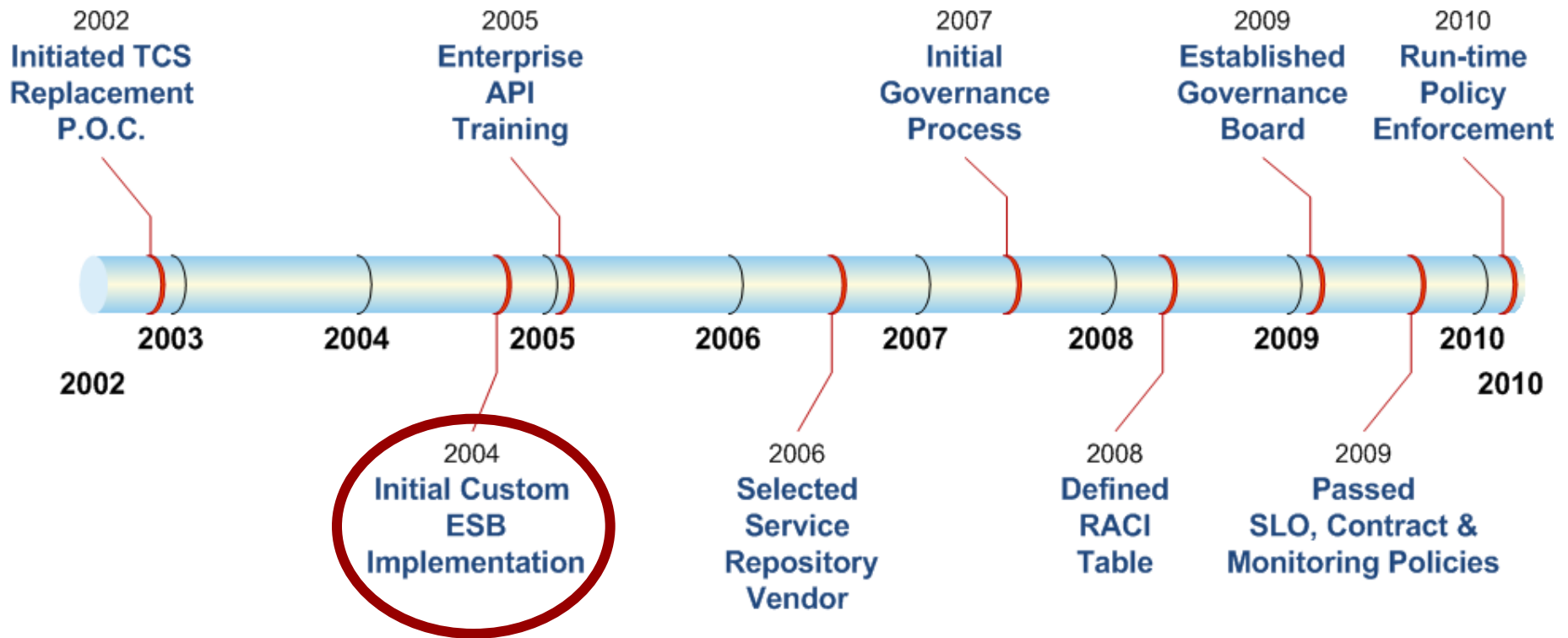
# Proof of Concept

- Understand the issues
- Non-monolithic
- High availability
- Hot upgrades (HW/SW)
- Clustered Linux devices
- Specialized processors
- Test I/O /etc under 10X loads
- Select / Test tools
- Build a core team

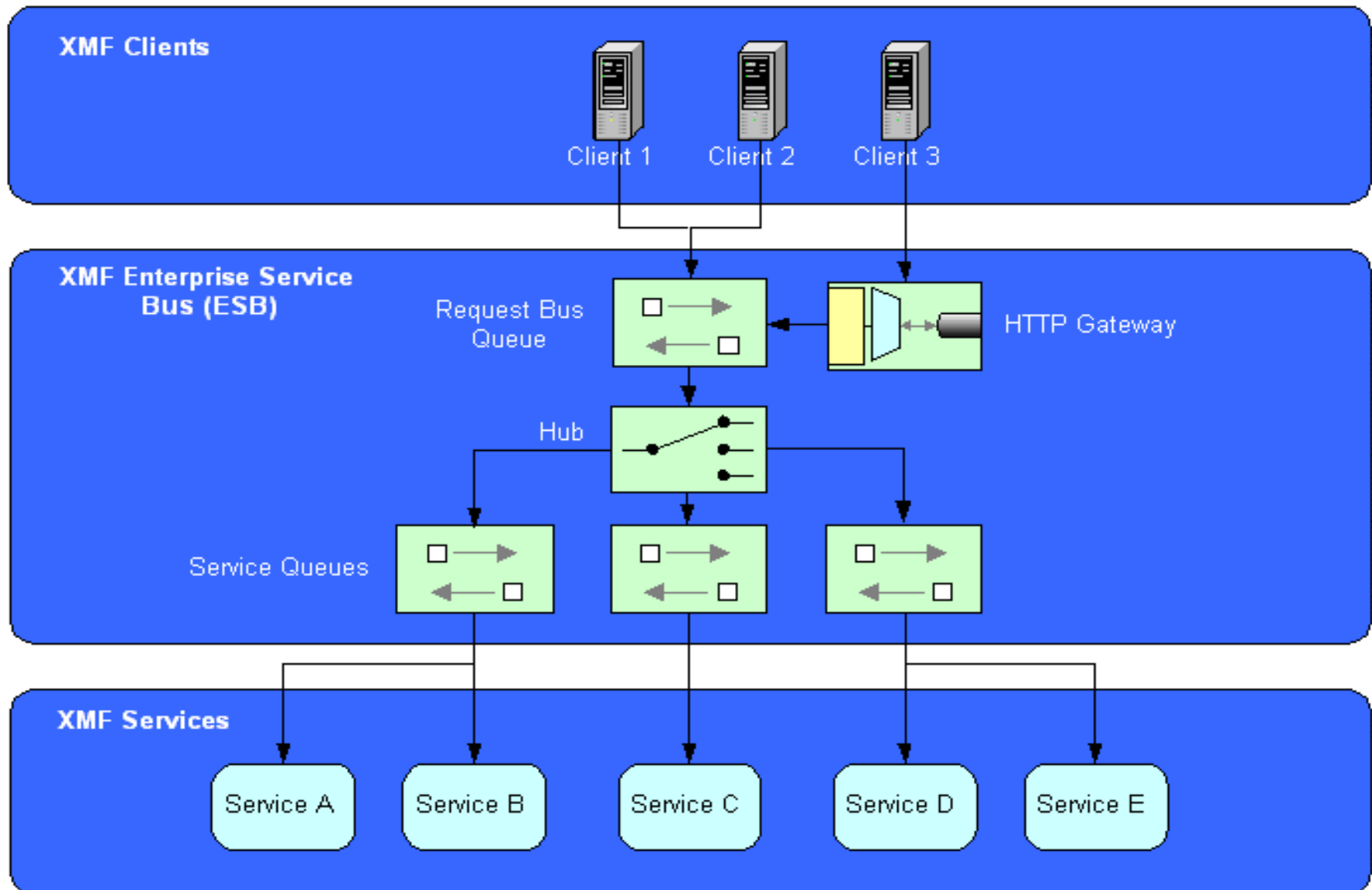




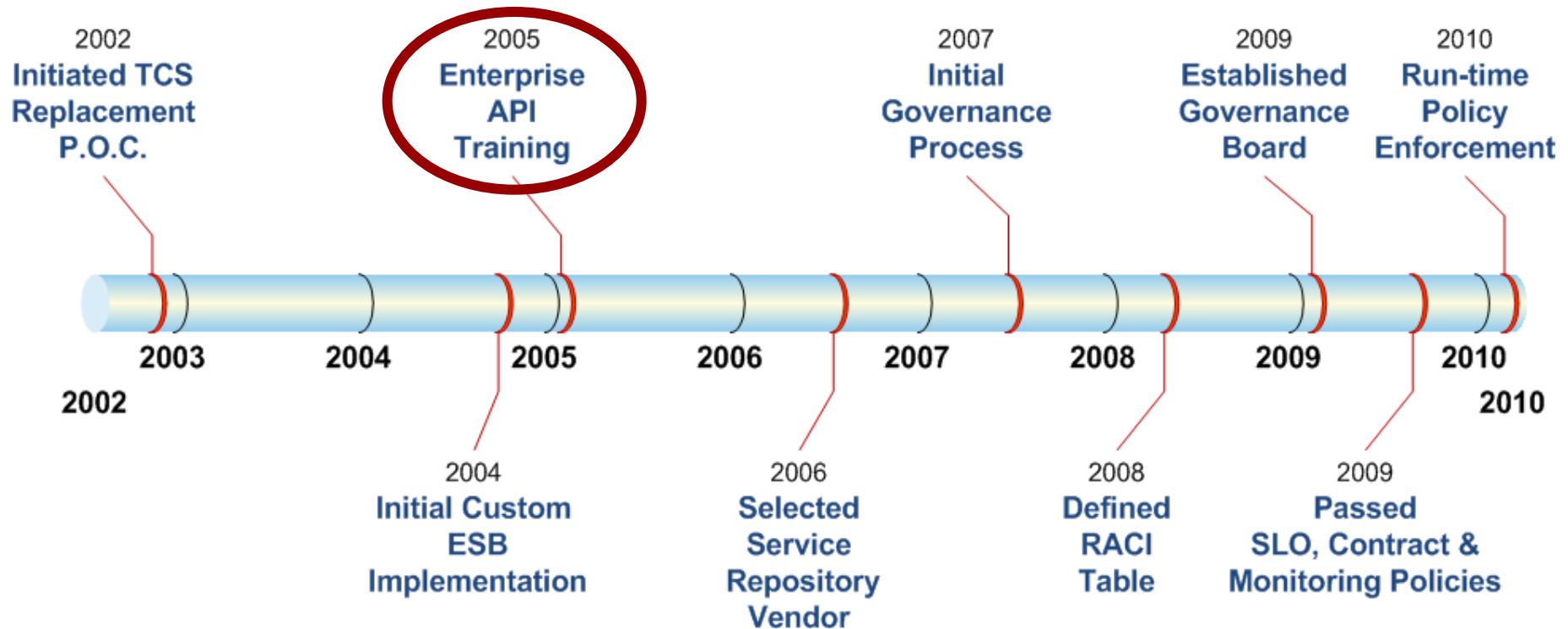
# History of SOA at UP



# Custom Enterprise Service Bus (XMF)

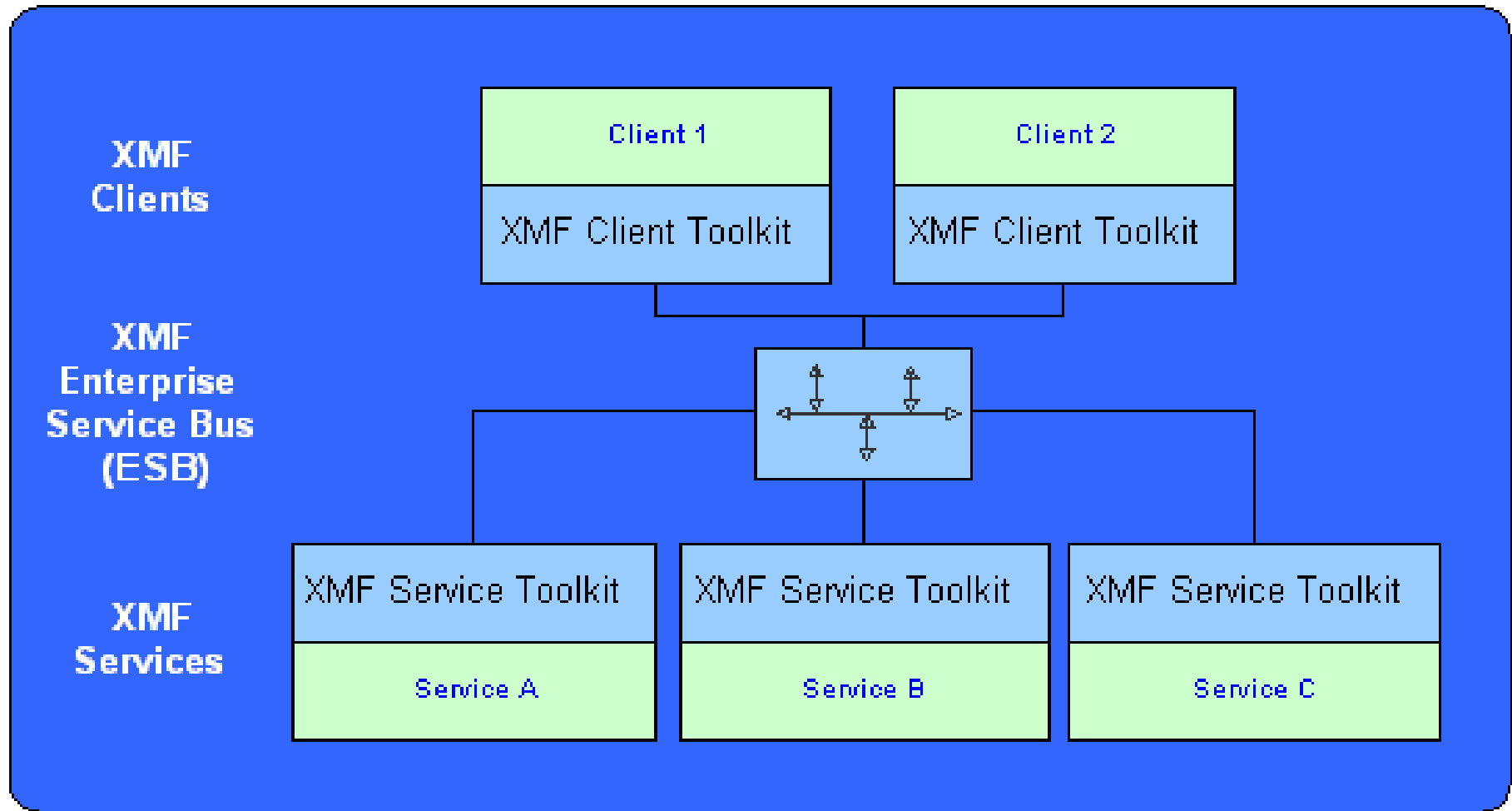


# History of SOA at UP



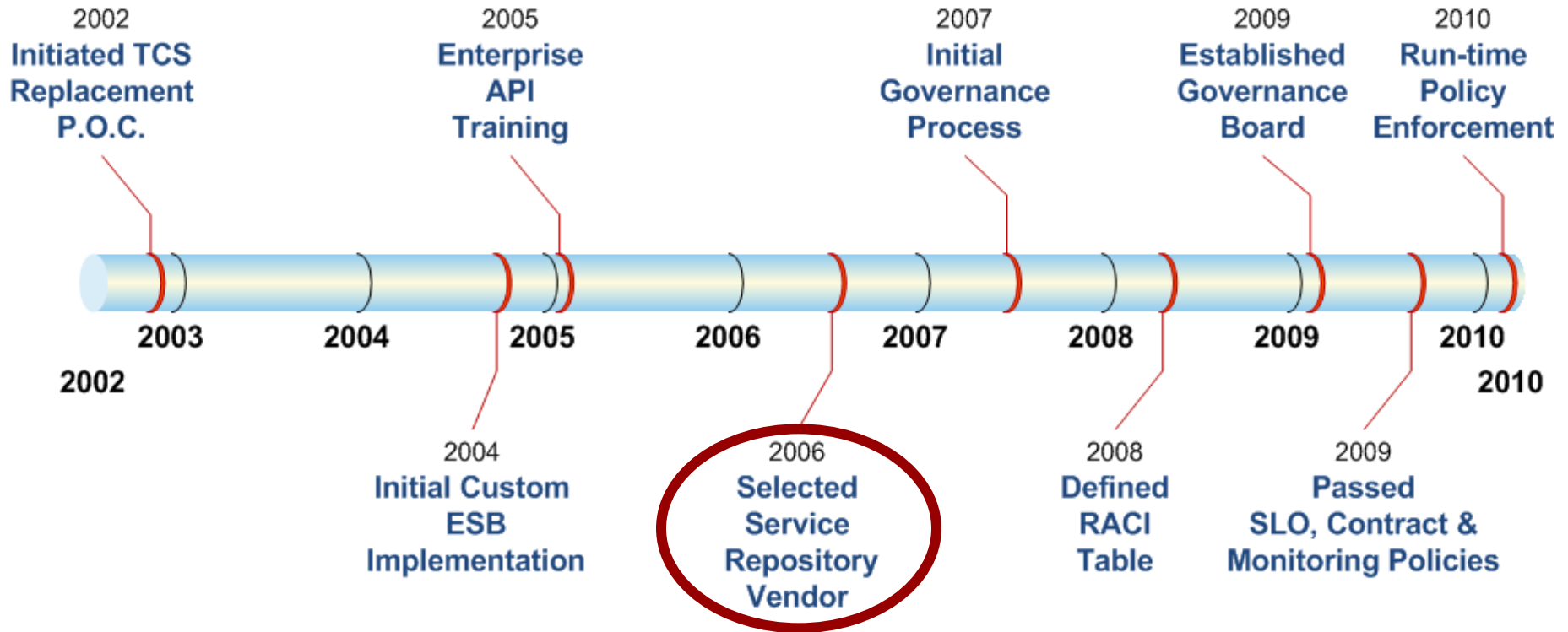
# Enterprise API Training

## *XMF Client and Service Toolkits*





# History of SOA at UP



# Selected Service Repository Vendor

Home - HP SOA Systinet - Windows Internet Explorer provided by Union Pacific

http://service-repository.www.uprr.com/soa/web/service-catalog/design/home?history=2.36&submit\_1e27fbf8dc435

Live Search

Home - HP SOA Systinet

POWERED BY  
HP SOA Systinet

igen009 ( My Profile | Help | Sign Out )  
as Service Publisher ( change )

Dashboard Services Policies Tools

View

Categories

My Services  
All Services

Compliance Reports

New

Application  
Business Process  
Project  
Service  
Business Policy

Add Portlet

Content Feed  
Content Report  
Content Report  
Navigator Bookmarks  
My Task Results  
Business Policies  
Compliance Failure Scores  
Implementations  
Reports Waiting for Review  
Documentation

**Reuse Statistics**

Refresh

0	214	<div></div>	87%
1~2	26	<div></div>	11%
>2	5	<div></div>	2%

Contract Requests to Approve  
My Contracts

**Contracts**

Visit feed home page  
Refresh

- dras998 / GetMileageService
- track/physical/find/1.0 / GetService\_HTTPEndpoint
- track/physical/get/1.0 / GetService\_HTTPEndpoint
- dair999 / Get Road Crossing 1.1
- dsbr999 / utility/managed-content/get-object/1.0 xdev HTTP endpoint

Shown 5 of 25 entries in feed.

**Services**

Visit feed home page  
Refresh

- person/find-scheduled-offering/1.0
- person/validate-training/1.0
- person/find-scheduled-offering/1.0
- shipment/update-equipment-weight/1.1
- equipment/unassign-from-customer-order/1.0

Shown 5 of 25 entries in feed.

**Service Level Objective**

Visit feed home page  
Refresh

- find-scheduled-offering\_slo
- person/valiate-training/1.0SLO
- person/update-misc-events/1.0
- MLG SLO
- FileNet Find Document Status

Shown 5 of 25 entries in feed.

**Blog: Making Sense of**

Visit feed home page  
Refresh

- Join us for SOA, App Modernization and Governance insights at HP Software Universe 2010!
- Delta's SOA outcome, flying high and seeing the results of their efforts...
- Looking for better business outcomes with SOA? - Mind the Gap
- "Carnac the Magnificent's" 10 Predictions for Applications in 2010

**Activity Report**

Year Read

Mon Oct 26 14:00:17 CDT 2009

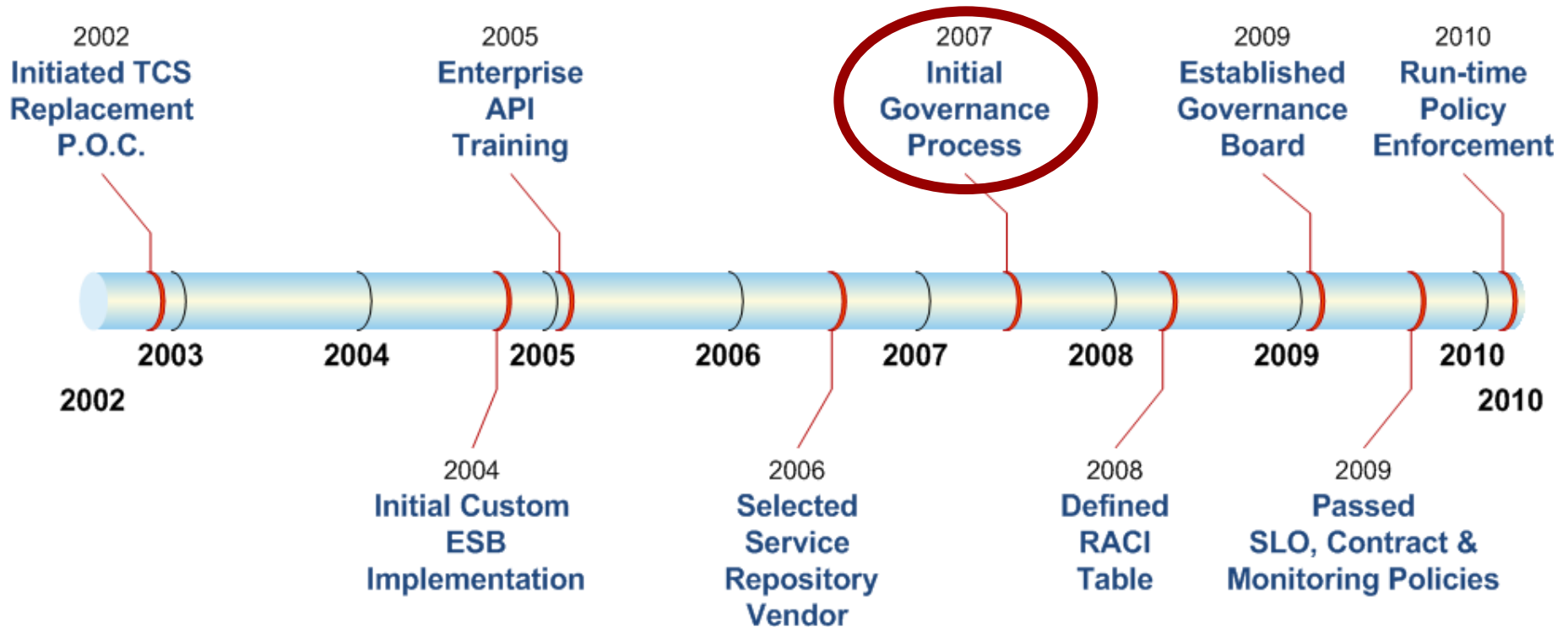


Local intranet 100%



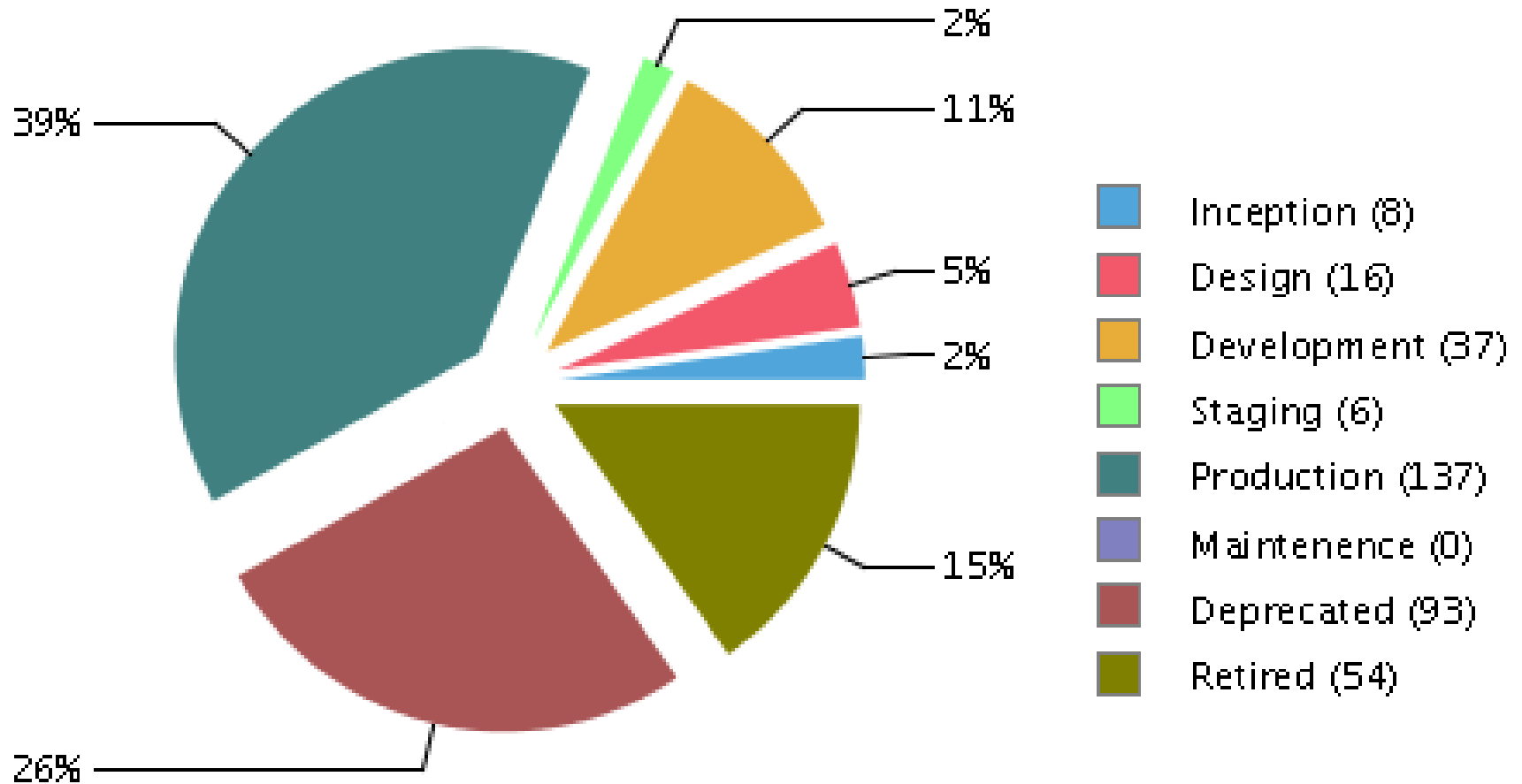
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# History of SOA at UP



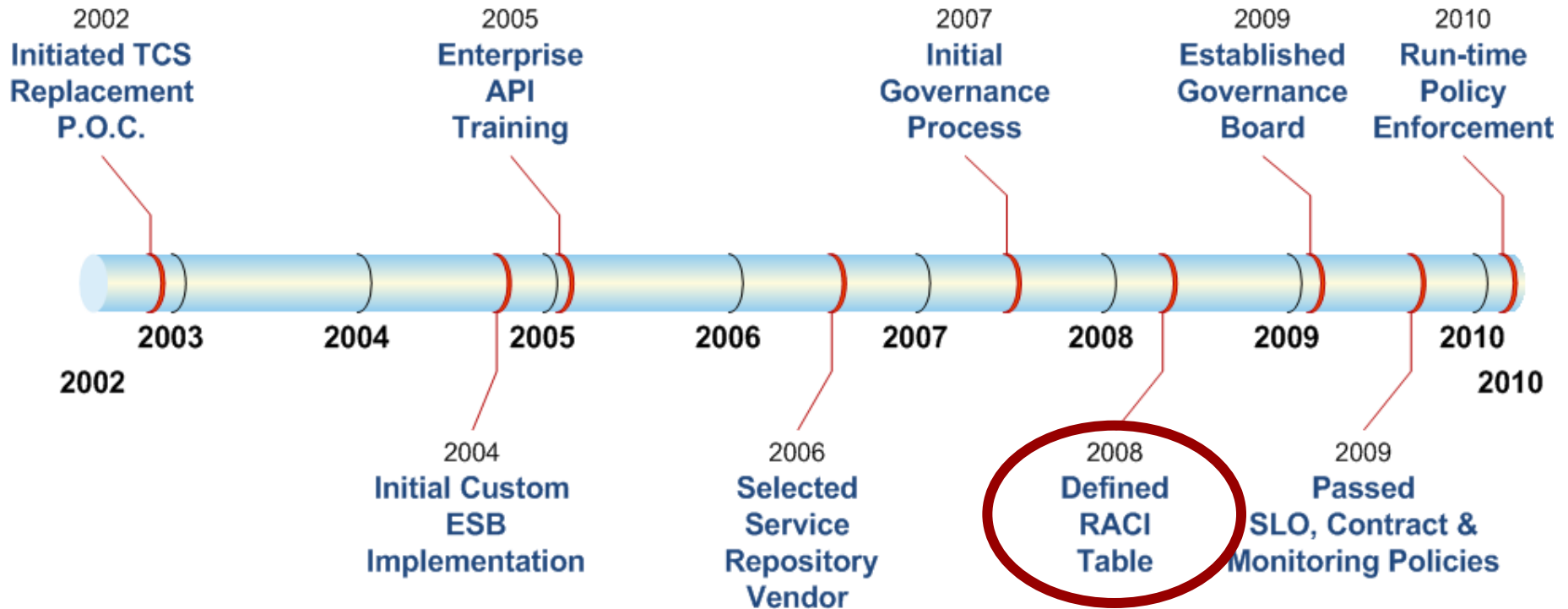
# Initial Governance Process

## *Service Life Cycle*





# History of SOA at UP



# Defined RACI Table for SOA Governance at UP

	Business Analyst	Application Architect	Service Reviewer*	Data Architect	Service Provider Project Manager**	Service Consumer Project Manager**	Testing & Change Team	Architecture Team	SOA Champion	SOA Governance Sponsor
SOA Governance - Completeness	C			C	I		C	C	A	S
Business Process Definition	A	C		R	R				R	R
Enterprise Service Identification	R	R	C	C	I	R		I	A	I
Service Classification	R	R	C	C	I	R		I	A	I
Service Portfolio Management	R	R	C	C	R	I		I	A	S
SOA Reference Architecture		R			I			R	A	S
Service Design Artifacts Policy		C			I			C	A	C
Service Design Artifacts		R			R				S	
Service Interface Documentation	C	A	C		A	C			V	
Service Interface Development		A	C	C	R	C			C	
Service Interface Automated Validation		I	C	C	I		R	A	C	
Service Interface Review		A	S	S	R			C	C	
Service Interface Policy - Naming and Structure		R	A	C	R				S	
Service Interface Policy - Information Standard		R	C	A	R				C	
Service SLA Contract	C	A			A	R		C	S	
SOA Test Strategy		C			I		A	C	C	I
SOA Test Result Review		R			A		S		C	S
Service Logging	C	A			C				C	
Service Monitoring	C	A			C				C	
Service Contract Enforcement	C	R			R	R		A	R	
Service Performance Trending	C	A			R	C	C	R	C	

## Notation

R	Responsible, participates in the work
A	Accountable (among those responsible, a single person or group that is the authority to ensure successful completion)
C	Consulted, on a need basis
I	Informed, one way communication of any key decisions
V	Verifies the results of the activity (hence establishes the policy and identifies policy violations but activity completion does not wait for verification to complete)
S	Signs-off on the results (hence establishes the policy and enforces the policy, activity is not complete until sign-off is done)

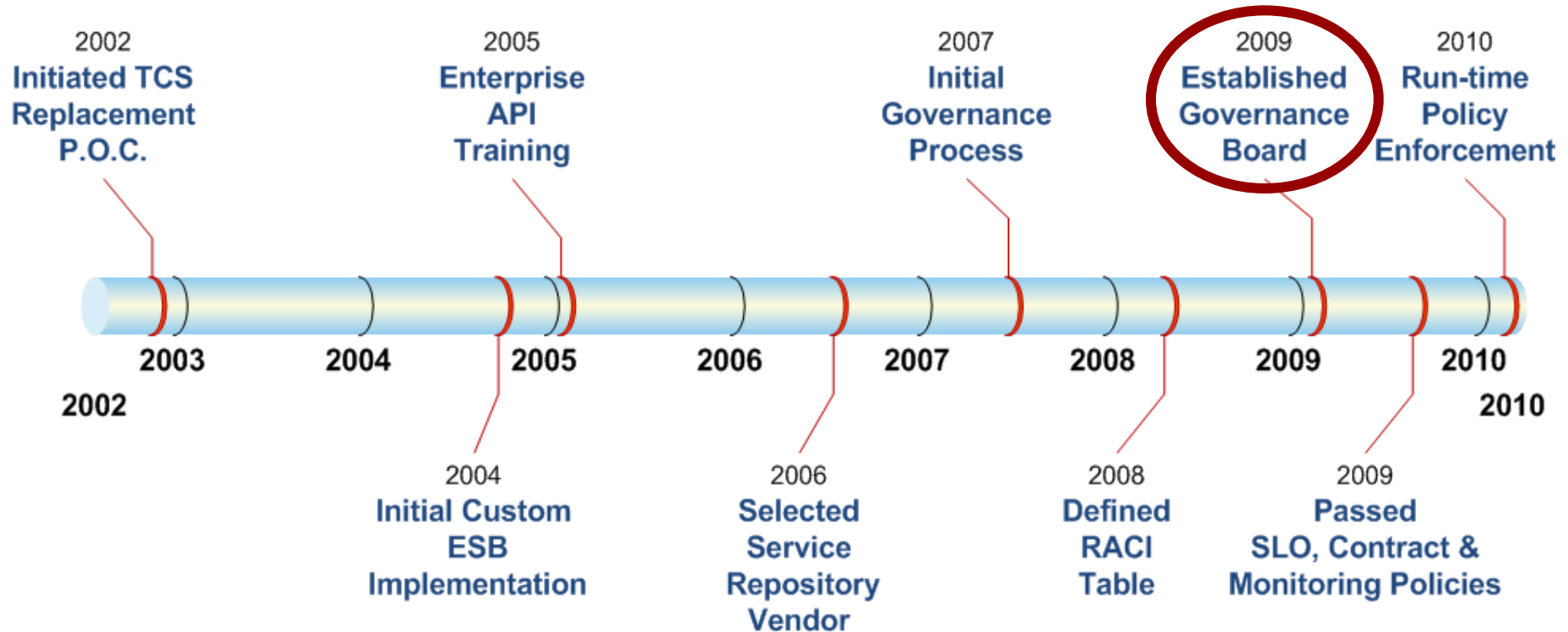
\* a committee

\*\* includes developers



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# History of SOA at UP



# Established SOA Governance Board

## *Charter, Goals and Benefits*

- **Charter**

- The SOA Governance Board will, through a set of Policies and Processes, provide Leadership, Oversight, and Enforcement of the management of the Service Oriented Architecture at UP

- **Goals**

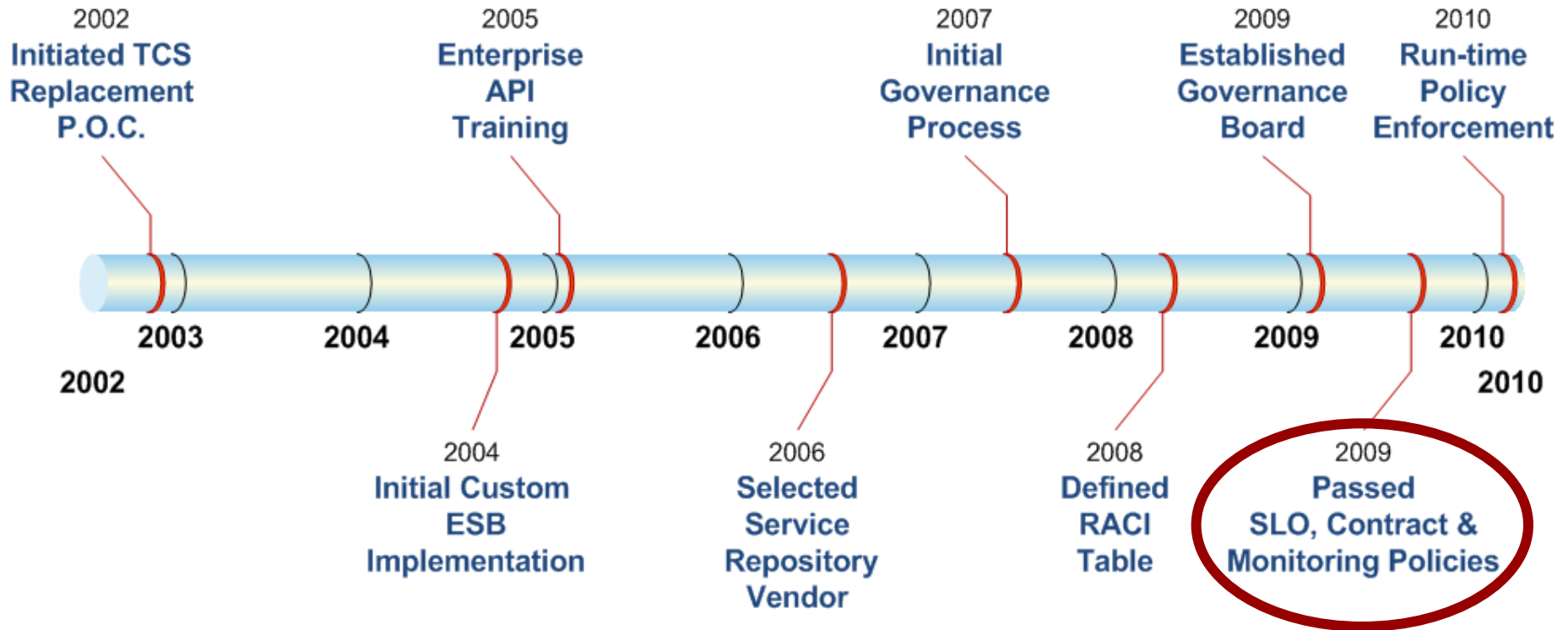
- Govern all aspects of services including ownership, version control, testing and release management
- Maintain the Responsible, Accountable, Informed and Consulted (RACI) Matrix

- **Benefits**

- Promotes consistency and repeatability which lower development costs
- Accelerates delivery of solutions
- Facilitates adoption of technology, standards and best practices
- Share lessons learned from completed projects
- Improves availability and performance through managed services



# History of SOA at UP



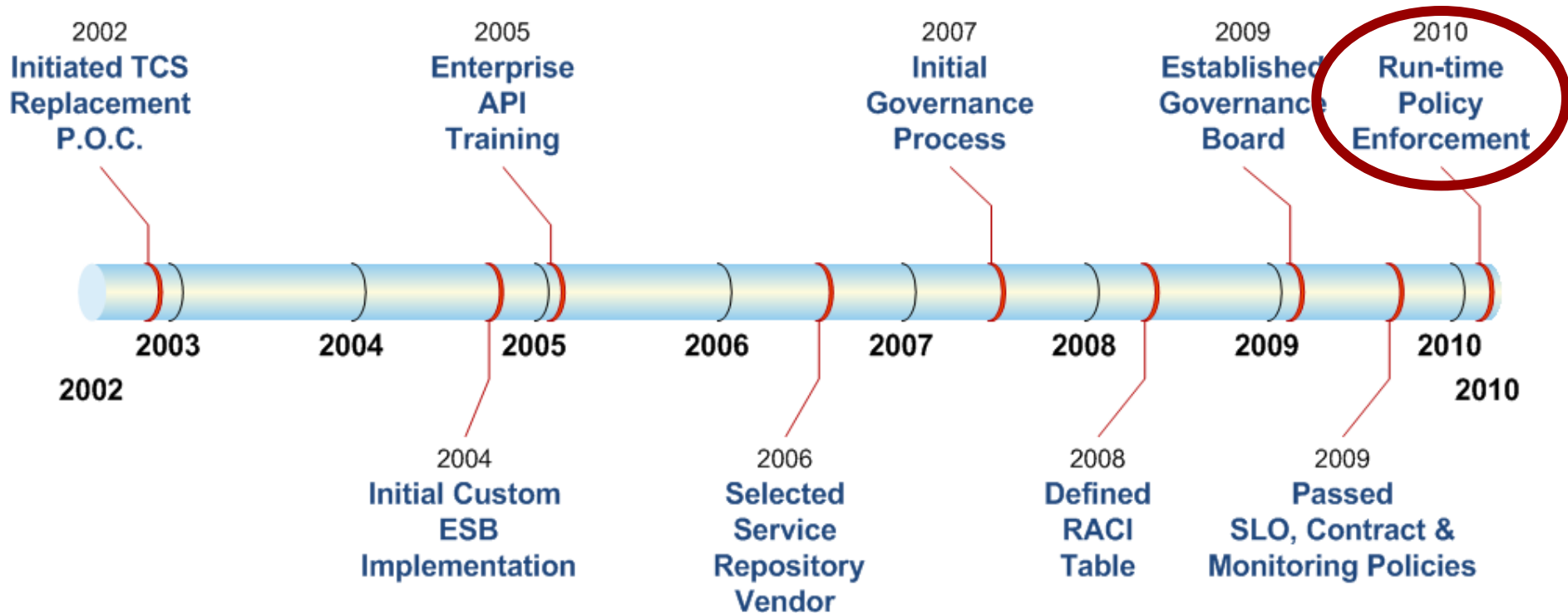
# SOA Governance Board Policies

- **Abbreviated Service Lifecycle Stages**
  - Reduced from 13 to 8
- **Unique Consumer Identifier**
  - Require all consumers to be uniquely identified
- **Service Level Objectives (SLOs)**
  - Require all services to have at least one SLO
- **Consumption Requests (Contracts)**
  - Require a contract between consumer and service before consumption
- **Service Monitoring**
  - Require an availability and throughput monitor for every service



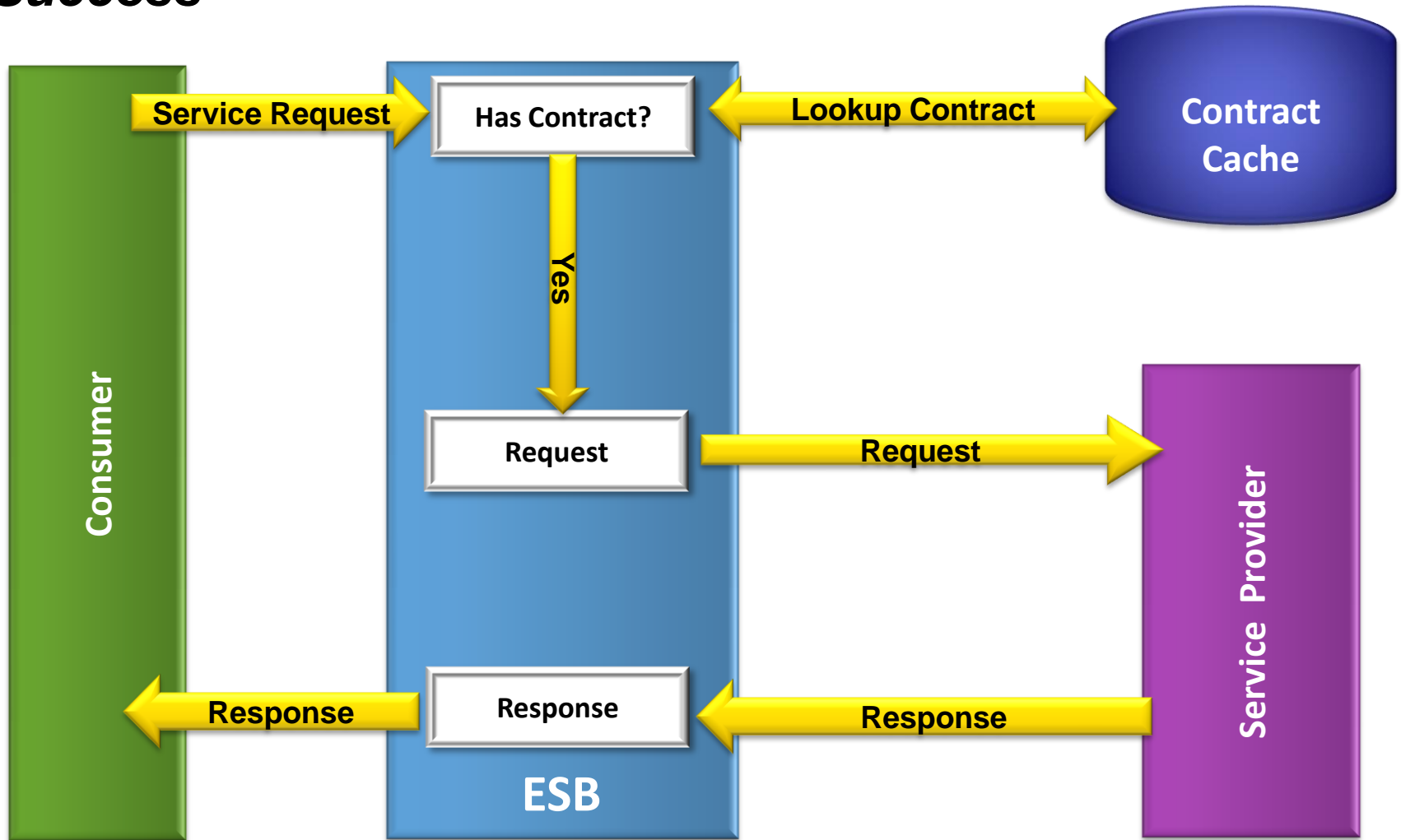


# History of SOA at UP



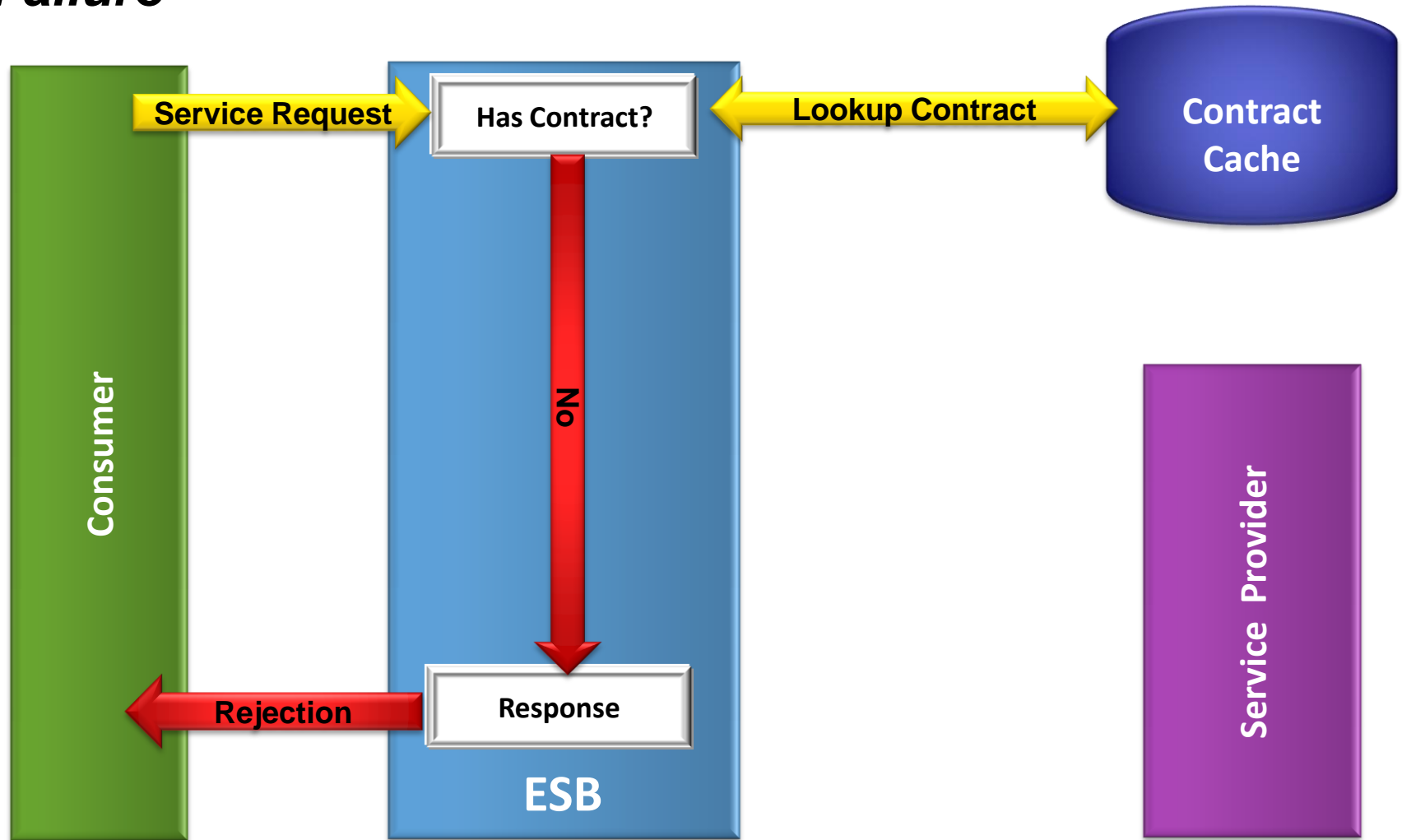
# Run-time Policy Enforcement of Contracts

## Success



# Run-time Policy Enforcement of Contracts

## *Failure*



# Cultural / Management Issues

- Think long term
- Train / Train / Train
- Everyone “gets on board”
- Incremental steps



**Find and empower the technical experts,  
but.....expect them to “own” their results**

# Reality Check

- **The SOA Promise**

- **Business Services**

- **Self Contained Business Functionality**

- **Interoperability**

- **Distributed systems can be developed independent of the service**

- **Loose Coupling**

- **Reducing system dependencies**





# Reality Check

- **Our Results**

- **Business Services – Slow Progress.**

- 79% of services are database get, find.
    - Business services take longer to develop

- **Interoperability – Success, but required custom development.**

- Custom ESB aided us here!

- **Loose Coupling – Largely Unsuccessful.**

- Governance processes and tools built to manage dependencies



# Key Learnings

- **Teamwork is paramount**
- **Everything isn't a service**
- **Governance needs to be visible**
- **Oil Tanker vs. Speedboat**
- **A vendor can NOT sell you a SOA solution**





Command or Search

Go

My Top Functions

+ Bookmarks

+ Car

+ Crew

+ Intermodal

+ Locomotive

+ Mechanical

+ System Inquiry

+ Terminal

+ Train

+ Employee

+ Help

+ News

## Message Board

Func. Date/Time

- Completed (0)

- Processing (0)

## UPOnline

[New Terminal Supports  
Customer Growth](#)[LA Fires No Threat, Yet](#)[Weekly Safety Topic:  
Loading/Unloading Lugga...](#)[Safety Incident Rate](#)[NetControl Replaces  
Mainframe Green Screen](#)[Service Unit Newsletters](#)[LR Connection](#)UNION PACIFIC  
BUSINESS BUILDER

My Work

New Tab

## Call Sheet

Employee not on duty

## Limo/Van Status

No Van Called within the last  
24 hours

## View Messages

## Enterprise Broadcast Messaging

You have no new messages.

## Orders And Bulletins

## System

General Orders	Download	Modified
<a href="#">System GO</a>	<a href="#">PDF</a> <a href="#">iSilo</a>	09/01/09

Rule Books	Download	Modified
TRANSPORTATION	<a href="#">PDF</a> <a href="#">iSilo</a>	09/01/09
<a href="#">GCOR</a>	<a href="#">PDF</a> <a href="#">iSilo</a>	07/24/09
<a href="#">Train Disp</a>	<a href="#">PDF</a> <a href="#">iSilo</a>	08/07/09
<a href="#">Air Brakes</a>	<a href="#">PDF</a> <a href="#">iSilo</a>	08/13/09
<a href="#">Safety</a>	<a href="#">PDF</a> <a href="#">iSilo</a>	08/07/09
<a href="#">SSI</a>	<a href="#">PDF</a> <a href="#">iSilo</a>	09/01/09
<a href="#">Hazmat</a>	<a href="#">PDF</a> <a href="#">iSilo</a>	09/01/09
ENGINEERING	<a href="#">PDF</a> <a href="#">iSilo</a>	07/24/09

## EQMS

EQMS Score: 1000

• [About Employee Score?](#)

## Certification

No information found.

## Timetables

## Timetable by Area:

Select or type timetable and

View

## Timetable by Subdivision:

Select or type subdivision

View

## Side by Side Outbound Summary

Simple

Advanced

Current Profile: Home2

[Edit Profiles](#)

Data as of:

Board 1 - RE70 - SP317

Board 2

Train Lineup - SP317 for RE70

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